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## The Growth Response of Oil Palm Seedling at Main Nursery against Watering at Different Volume and Frequency and Against Provision of Compost

Mira Ariyanti<sup>a\*</sup>, Santi Rosniawaty<sup>b</sup>, Intan Ratna Dewi<sup>c</sup>, Aldo Fernando<sup>d</sup>

<sup>a</sup>Department of Budidaya Pertanian, Faculty of Agriculture, University of Padjadjaran, Jalan Raya Bandung-Sumedang km.21, Jatinangor, West Java, Indonesia

<sup>a</sup>Email: [mira.ariyanti@unpad.ac.id](mailto:mira.ariyanti@unpad.ac.id)

### Abstract

The purpose of this research is to know the growth response of oil palm seedling by doing watering at different volume and frequency combined with the provision of fertilizer compost during main nursery. The experiment was done from April 2017 until August 2017. It was conducted at the Ciparanje Experimental Garden, University of Padjadjaran, West Java by using random block design as the method of the experiment. Treatments consisted of volume watering (without, 1.5 l, 2 l; 2.5 l), intervals watering (without watering, every 2 days, every 3 days) which is also accompanied by provisioning compost (without, 2 kg). The results of the research show that watering volume 1.5 l - 2.5 l polybag-1 given every two or three days was the steady optimum range to favor the growth of oil palm seedling when accompanied by fertilizing with EFB compost. Watering 1.5 l polybag-1 every two days was tend to influentially good against the additional average of plant height oil palm seedling up to 12 WAP and on 16 WAP water needed was tend to be decreasing and was sufficiently sprayed every three days with the same watering volume alongside with 2 kg EFB compost fertilizing.

**Keywords:** Oil palm seedling; watering; compost.

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\* Corresponding author.

## **1. Introduction**

The total area of the oil palm plantation in Indonesia up to 2017 is 12.307.677 ha, the total production is 35.359.384 tons with volume and the value of total production respectively as much as 1.126.194 tons, 1.276.098.000 USD on 2016 [1]. Palm oil (*Elaeis guineensis* Jacq) is very important plantations in Indonesia as a source of foreign exchange revenue to the country and in this case, Indonesia is largest producer of crude palm oil in the world followed by Malaysia, Thailand, Nigeria, Colombia, and other countries [2,3].

Palm oil is becoming one superior sectors of plantation crops because it is as the main source non-oil foreign exchange revenue for Indonesia. The increasing trade of vegetable oil the world create a big chance for Indonesia to become the world biggest supplier. This is also has driven the government of Indonesia to continually increasing the production and productivity of oil palm plantation. The industry of oil palm is one of strategic industry for Indonesia, because this agricultural sector (agro-based industry) is largely growing in tropical countries such as Indonesia, Malaysia and Thailand.

Palm oil productivity increment can be done since a nursery [4]. One important aspect that needs to be considered in seeding palm oil is provision of good seed, healthy and uniform [5]. A nursery is a beginning step that very much determine planting palm oil in the field. Superior seedling will be obtained from the well processed of a nursery which therefore will play an important role in order to achieve high productivity and quality of oil palm [5]. In the process of oil palm nursery two aspects that deserve consideration: the principle of fertilizing and management of water. Fertilizing and management of water is very influential on the growth of oil palm seeds [6].

Fertilization of oil palm nursery stadia can be done by granting a form of organic fertilizer compost [4,6]. Organic fertilizers have more advantages than inorganic fertilizer. This is because the capability of organic fertilizers to improve physical, chemical and biological properties of soil, and its ability to provide carbon compound that improve the physical properties of and agrobiolology of soil [7,8].

The addition of organic ingredient can improve the distribution of soil pore size of soil which turn out increasing the water holding capacity so that the availability of water getting increased and could be used more by plants in long term [9,7,6]. Optimizing of compost granting and determination of the volume and frequency of watering on the nursery phase plays an important role for the success of the oil palm cultivation. The availability of water is essential to meet the needs of water plant [10]. Deficiency of water and nutrition can affect the plant at all levels, the metabolism, physiology and morphology of plants [11]. The deficiency (of water and nutrition) on palm oil can affect biomass partitioning, nutrients concentration, and the morphology and physiological of plants [12]. Therefore, the purpose of this research is to study the growth response of palm oil plantations in the main nursery at different watering on the volume and frequency and the provision of compost.

## **2. Materials and Methods**

The materials used in this research is Tenera oil palm seedling from Pusat Penelitian Kelapa Sawit (PPKS) D x P Varietas SP2 three (3) months old, polybag 30 cm x 40 cm x 50 cm, water, empty fruit bunch (EFB) compost.

The instrument used in this study are: a measuring glass, agricultural equipment, the balance analytic, calipers, bamboo for shade.

### **3. Study Area**

The experiment was carried out in a screen house at Ciparanje Experimental Garden, Faculty of Agriculture University of Padjadjaran, Jatinangor sub district, Sumedang district, West Java. The altitude of the place is around  $\pm 750$  meters above sea level, the ordo of the land is Ultisol. Type of the precipitation of rain is type C. This experiment was carried out from April 2017 to August 2017.

### **4. Experimental Design**

The experiments used the experimental methods with random block design (RBD). Experiment consisted of ten treatments with three replications thereby contained 30 units of treatments. Every unit experiment consisted three oil palm seedlings. The treatments are: control, watering with 1.5 l polybag-1 every day, watering 1.5 l polybag-1 every two days, 2 kg of compost, watering 1.5 l polybag-1 every three days, 2 kg of compost, watering with 2 l polybag-1 every day, watering 2 l polybag-1 every two days, 2 kg of compost, watering 2 l polybag-1 every three days, 2 kg of compost, watering with 3 l polybag-1 every day, watering 3 l polybag-1 every two days, 2 kg of compost, watering 3 l polybag-1 every three days, 2 kg of compost.

The influencing factors on the growth of oil palm seedlings were analyzed by F-test different analysis on significance level 5% and if subsequently is followed by Duncan multiple range test (DMRT) at 5% significant.

### **5. Results and Discussion**

Table 1 shows that oil palm seedling without watering and not fertilized (control) produce the lowest of average addition plant height that is caused by the plant which were dead. Watering and fertilizing factors are determinant factor to the growth of plants especially its plant height where it is a visual indicator which can differentiate if oil palm seedling is good quality or not. Watering 1.5 l polybag-1 every two days was tend give influential good against the addition of average of plant height up to 12 weeks after treatment (WAP) and on 16 WAP needed water for the plant seedling was tend to decrease to every three days watering with the same volume along with fertilization with compost. According to [13], watering interval has significant influent on the growth of cashew nut on the plant height, diameter of stem, number of leaves, the volume of the root, the number of the root, and number of primary branches. In addition, plant height is influenced by genetic plant varieties and the days of seedling of oil palm [14].

Watering treatment with added compost significantly impacting the addition of plant height, this because compost increases C-organic content, N-total, Ca, Mg, K, Cu and Zn significantly [15], consequently nutrition source to plant increased, and will improve the growth of the plant.

The variety that was planted is Simalungun which genetically able to reach plant height to 75-80 cm. Table 1 provides data of average increment of plant height, only around 1.66 - 2.8 cm month<sup>-1</sup> which is lower than its

genetic potential 6.25 - 6.67 cm year<sup>-1</sup>. This is due to polybag size less in accordance with the age oil palm seedling causing its roots less developed and in turn disturbing the growth of plants.

**Table 1:** The influence of watering and fertilizer compost against the average plant height of oil palm seedling (cm) at 4 WAP, 8 WAP and 12 WAP

Treatments	The average of plant height of oil palm seedling (cm)		
	4 WAP	8 WAP	12 WAP
Control	1.70a	0.71b	0.71b
Watering 1.5 l polybag <sup>-1</sup> everyday	1.66a	2.12a	2.34a
Watering 1.5 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	1.95a	2.31a	2.54a
Watering 1.5 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	1.89a	2.23a	2.80a
Watering 2 l polybag <sup>-1</sup> everyday	1.92a	2.19a	2.37a
Watering 2 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	1.84a	2.11a	2.57a
Watering 2 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	1.96a	2.32a	2.78a
Watering 3 l polybag <sup>-1</sup> everyday	1.75a	2.09a	2.27a
Watering 3 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	1.88a	2.19a	2.61a
Watering 3 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	1.78a	2.19a	2.55a

Note: Values in the same column followed by different letters show significant differences at 5% DMRT

WAP: weeks after treatment

**Table 2:** The influence of watering and fertilizer compost against the average diameter of stem of oil palm seedling (cm) at 4 WAP, 8 WAP and 12 WAP

Treatments	The average diameter of stem of oil palm seedling (cm)		
	4 WAP	8 WAP	12 WAP
Control	0.22c	0.00 b	0.00b
Watering 1.5 l polybag <sup>-1</sup> everyday	0.39ab	0.79a	1.28abc
Watering 1.5 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.38ab	0.76a	1.177bc
Watering 1.5 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.45ab	0.88a	1.26abc
Watering 2 l polybag <sup>-1</sup> everyday	0.35b	0.81a	1.06c
Watering 2 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.40ab	0.82a	1.22bc
Watering 2 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.38ab	0.85a	1.29abc
Watering 3 l polybag <sup>-1</sup> everyday	0.38ab	0.76a	1.21bc
Watering 3 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.46a	0.95a	1.56a
Watering 3 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.42ab	0.84a	1.42ab

Note: Values in the same column followed by different letters show significant differences at 5% DMRT

WAP: weeks after treatment

Volume of watering 1.5 l - 2.5 l polybag-1 that was given every two or three days upon is an optimum range to favor the growth oil palm seedlings when accompanied by fertilizing with EFB compost. The parameters of growth which were affected are: diameter of stem and the number of leaves. The growth of diameter of stem up to 16 WAP need more water which 2.5 l is about polybag-1 by watering intervals every 2 days along with EFB compost provision (Table 2). This was consistent with [16], stating that the role of organic matter is very important in improving the soil to hold water. The improvement of soil capability in holding water impacting the plant roots to absorb nutrition easier for growth.

The average increment of leaves number influenced by genetic trait of plants where oil palm naturally grows one leaf every month. According to [17], every month appears one leaf of oil palm until seedlings 6-month-old. Table 3 shows that the increase of average increment of oil palm seedling leaves number are 1.35 per month.

**Table 3:** The influence of watering and fertilizer compost against the average increment of leaves number of oil palm seedling (cm) at 4 WAP, 8 WAP and 12 WAP

Treatments	The average number of leaves of oil palm seedling (cm)		
	4 WAP	8 WAP	12 WAP
Control	0.71a	0.71b	0.71b
Watering 1.5 l polybag <sup>-1</sup> everyday	0.97a	1.31a	1.90a
Watering 1.5 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.84a	1.24a	1.81a
Watering 1.5 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.97a	1.35a	1.74a
Watering 2 l polybag <sup>-1</sup> everyday	0.78a	1.26a	2.00a
Watering 2 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.90a	1.39a	1.87a
Watering 2 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.90a	1.43a	1.90a
Watering 3 l polybag <sup>-1</sup> everyday	0.84a	1.41a	1.61a
Watering 3 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	0.88a	1.44a	1.88a
Watering 3 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	0.78a	1.31a	1.84a

Note : Values in the same column followed by different letters show significant differences at 5% DMRT

WAP : weeks after treatment

Table 4 shows that the watering and fertilizing compost did not affect the chlorophyll content of leaves. The content of chlorophyll leaves more influenced by genetic factor where in the end will affect the level of

photosynthesis that occurs. The content of chlorophyll leaves of oil palm seedling at 12 WAP is around 38.6 - 47.04.

**Table 4:** The influence of watering and fertilizer compost against the chlorophyll content of oil palm seedling (cm) at 12 WAP

Treatments	Chlorophyll content of oil palm seedlings (CCI) at 12 WAP
Control	38.60a
Watering 1.5 l polybag <sup>-1</sup> everyday	43.56a
Watering 1.5 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	40.63a
Watering 1.5 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	44.21a
Watering 2 l polybag <sup>-1</sup> everyday	35.98a
Watering 2 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	42.41a
Watering 2 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	47.04a
Watering 3 l polybag <sup>-1</sup> everyday	42.60a
Watering 3 l polybag <sup>-1</sup> every 2 days + 2 kg of compost	41.70a
Watering 3 l polybag <sup>-1</sup> every 3 days + 2 kg of compost	42.51a

Note : Values in the same column followed by different letters show significant differences at 5% DMRT

WAP : weeks after treatment

The measurement of physiological character as chlorophyll content is one of the approaches to study the influence of water stress on the growth and production, because this parameter closely related to the rate of photosynthesis [18]. One aspect photosynthesis which is highly sensitive to water stress is biosynthesis of chlorophyll and the formation of protochlorophyll stranded at potential water just below 0 atm [10]. Chlorophyll can accommodate light that is absorbed by other pigments through photosynthesis, so that chlorophyll is called as a pigment of photosynthesis central reaction [19]. Water stress on coconuts dwarf green (*Cocos nucifera*) decrease in the concentration chlorophyll leaves per unit of leaf area [20].

## 6. Conclusion

The volume of watering 1.5 l - 2.5 l polybag<sup>-1</sup> given every two or three days is the optimum range to favor the growth oil palm seedling when accompanied by fertilizing with EFB compost.

The growth of oil palm seedlings which is influenced are: diameter of stem, number of leaves.

Watering 1.5 l polybag<sup>-1</sup> every two days is tend to influentially good against the addition average of plant height of oil palm seedling up to 12 WAP and on 16 WAP water need is tend to be decreasing which is sufficiently sprayed every three days with the same volume accompanied fertilizing 2 kg EFB compost.

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